DEVELOPING A CALL PROCESSING TIME STANDARD FOR THE PARKER FIRE DISTRICT.

EXECUTIVE ANALYSIS OF FIRE SERVICE OPERATIONS IN EMERGENCY MANAGEMENT

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: _____

Abstract

The problem was that the Parker Fire District (PFD), by no means, accurately defined call processing time in its *Risk Assessment and Standard of Response Coverage* (SOC) document for incidents where alarm notification is processed by multiple public safety answering points (PSAPs). The purpose of this research paper was to determine if any fire service standards exist with regard to call processing time for incidents where alarm notification is processed by multiple PSAPs; and to develop a call processing time standard for PFD. Action research was used to answer the following research questions:

1. Is there a fire service standard for call processing time where alarm notification is processed by multiple PSAPs?
2. What percentage of Colorado Front Range fire departments accurately track call processing time as a component of a standard of response?
3. What percentage of Colorado Front Range fire departments whose dispatch is not always the PSAP include total call processing time in their standard of response; including transfer time from the PSAP to PSAP and/or PSAP to fire dispatch?
4. What should the recommended call processing time be for PFD in its *Risk Assessment and Standard of Response Coverage*; and is it measurable?

The procedures involved using a literature review process to answer questions 1 and 4; and a survey of Colorado Front Range fire departments and subsequent interviews to answer questions 2 and 3.

The results of the research showed that there is only one national standard for call processing time where alarm notification is processed by multiple PSAPs. NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications*

Systems, Section 6.4.5 requires that transfers of calls from a primary PSAP to a secondary PSAP must be completed within 30 seconds 95% of the time. Fourteen of the 18, or 78% of Colorado Front Range fire departments surveyed track call processing time as a component of a standard of response. Of the six Colorado Front Range fire departments surveyed that have multiple PSAPs, none include transfer time from PSAP to PSAP and/or PSAP to fire dispatch as a component of call processing time measures or goals. The research determined that alarm transfer times from primary PSAP to secondary PSAP are measurable and should be routinely measured. Finally, the research determined that this component of call processing time should meet NFPA 1221 standards and should be adopted by PFD as a component of its SOC.

Recommendations included: (a) Revise PFD's *Risk Assessment and Standard of Response Coverage* and *Strategic Plan* documents to include multiple PSAP call processing standards that meet or exceed NFPA 1221, (b) Compile and evaluate multiple PSAP call transfer time data from the four PSAPs serving PFD, (c) Evaluate technological means to reduce 911 call transfer processing from primary PSAPs to PFD's dispatch provider, (d) Pursue grants to upgrade CAD technology to facilitate more timely data transfer between PSAPs, (e) Work with the State of Colorado E-911 Board of Directors and the four PSAPs serving PFD to legislate mandatory PSAP compliance with NFPA 1221 and implement Phase II of the FCC's mandated wireless E-911 program.

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Introduction

The problem is that the Parker Fire District (PFD), by no means, has accurately defined call processing time in its *Risk Assessment and Standard of Response Coverage* document for incidents where alarm notification is processed by multiple public safety answering points (PSAPs).

The purpose of this research paper is to determine if any fire service standards exist with regard to call processing time for incidents where alarm notification is processed by multiple PSAPs; and to develop a call processing time standard for PFD. Action research, including a literature review process, was used to answer the following research questions:

1. Is there a fire service standard for call processing time where alarm notification is processed by multiple PSAPs?
2. What percentage of Colorado Front Range fire departments accurately track call processing time as a component of a standard of response?
3. What percentage of Colorado Front Range fire departments whose dispatch is not always the PSAP include total call processing time in their standard of response; including transfer time from the PSAP to PSAP and/or PSAP to fire dispatch?
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Background and Significance

This applied research project is directly related to both the Executive Fire Officer Program's (EFOP) *Executive Analysis of Fire Service Operations in Emergency Management (EAFSOEM)* course; as well as supporting the United States Fire Administration's (USFA) operational objectives. The established goal for the EAFSOEM course is; "to prepare senior fire

officers in the administrative functions necessary to effectively manage the operational component of a fire department" (NFA, 2004, p. SM 1-2). According to Henri Fayol in his landmark work *General and Industrial Management*, one of these administrative functions is "controlling" (Carter & Rausch, 1989, p. 38). Dessler (2004) further defines the controlling function as "setting standards, comparing actual performance with these standards, and taking corrective action as required" (p. 3). Developing a call processing time standard is a critical component of a fire department's response goal; and essential to an effective Standards of Cover plan (Commission on Fire Accreditation International [CFAI], 2000, p. 3.37-3.44). Moreover, a call processing time standard impacts a fire department's operational emergency incident response to all hazards; directly relating and supporting all of the five USFA operational objectives (USFA, 2002, p. II-2). These objectives are:

1. Reduce the loss of life from fire in the age group 14 years old and below.
2. Reduce the loss of life from fire in the age group 65 years old and above.
3. Reduce the loss of life from fire of firefighters.
4. To promote within communities a comprehensive, multihazard risk-reduction plan led by the fire service organization.
5. To respond appropriately in a timely manner to emerging issues (p. II-2).

The Douglas County Sheriff's Office (DCSO) is under contract with the United Fire Dispatch Authority (UFDA) --- of which PFD is a member --- to provide emergency dispatch services to several fire service and law enforcement agencies, including PFD. DCSO Dispatch is the designated PSAP for all of unincorporated Douglas County.

PFD's service boundaries include areas within unincorporated Douglas County; as well as portions of unincorporated Arapahoe County, and the cities/towns of Aurora, Centennial,

Foxfield, Lone Tree, and Parker. In fact, the majority of PFD's jurisdiction lies within these areas outside of unincorporated Douglas County --- areas that are served by other primary PSAPs including designated PSAPs in Arapahoe County, the City of Aurora, and the Town of Parker. Consequently, a great many calls for service to PFD must be first answered, processed, and transferred by a primary PSAP other than Douglas County and then transferred to DCSO Dispatch for processing and fire dispatching.

The research is important because PFD has adopted minimum response time objectives as part of its *Risk Assessment and Standard of Response Coverage* (SOC) and *Strategic Plan* documents. PFD implemented these objectives because it recognizes that minutes and even seconds can make a difference in medical, fire, and other emergencies. Moreover PFD's fire station concentration and distribution models are predicated on *total reflex time* objectives; the time from receipt of an emergency call at the 911 PSAP until the first EMS or fire unit arrives on scene. PFD's *Strategic Plan* (2001) requires "fire and ALS units on scene within 6 minutes of receipt of 911 call, 70% of the time in designated urban areas" (n.p.). The *Strategic Plan* also requires "calls [to be] dispatched 90% of the time under 60 seconds with 95% essential accuracy" in accordance with NFPA 1221 standards (n.p.). These same minimum response time objectives are mirrored in PFD's SOC document.

What does this all mean? In the past PFD has not recognized a multiple PSAP component as part of its minimum response time objectives. Call processing times have been calculated and evaluated only after receipt at DCSO Dispatch --- PFD's communications center. However, a considerable number of these calls for service were routed through other primary PSAPs located in Arapahoe County, the City of Aurora, and the Town of Parker. In fact, approximately 25% of PFD's calls for service in 2004 were PSAP transfers to DCSO Dispatch

from another primary PSAP (Douglas County Sheriff's Office [DSCO], 2005, n.p.). These emergency responses are in effect "front-end-loaded" with an unreported and unknown number of seconds or minutes necessary to answer, process, and transfer the request for service initiated at the primary PSAP and then forwarded to DCSO Dispatch. Consequently, it is impossible for PFD to know what the actual *total reflex time* is for incidents reported to primary PSAPs and then transferred to fire communications at DCSO Dispatch. There are many future implications resulting from this inability to accurately and comprehensively measure, report, and evaluate call processing times for incidents where alarm notification is processed by multiple PSAPs. The most significant of these is the erroneous and incomplete data which affects PFD's ability to accurately measure service levels, plan for future stations, and anticipate staffing needs. Without the ability to quantify this segment of call processing time; service levels cannot be accurately measured or assessed, nor can effective strategic planning occur.

Literature Review

The purpose of this literature review is twofold: to determine whether there is an accepted fire service standard published at a national level for call processing time where alarm notification is processed by multiple PSAPs; and to review any historical documentation or studies relative to this topic. Information gleaned from the literature review process was incorporated into developing a call processing time standard for PFD. The author was able to find national standards for call processing times published by two recognized fire service agencies; the Commission on Fire Accreditation International (CFAI) and the National Fire Protection Association (NFPA). Of these two, only the NFPA publishes a national standard for call processing in which the problem of multiple PSAPs is identified. This standard differentiates and extracts transfers from a *primary* PSAP to a *secondary* PSAP as a fractal

measure. Finally, the author also found numerous articles and studies relative to this applied research project. Two, in particular, provided much insight relative to multiple PSAP emergency services communication systems.

The CFAI is "dedicated to ensuring continuous quality improvement within the fire and emergency services while supporting education, data collection, and research within the fire and emergency service industry" by providing "an in-depth process of self-assessment for fire and emergency service agencies, granting accreditation to those agencies who successfully complete the self-assessment and an on-site evaluation by their peers" (CFAI, n.d.). The CFAI's *Fire and Emergency Service Self-Assessment Manual* "is the result of thousands of hours of work by more than 150 fire-related professionals... developing the basis for the current set of documents, which include original research on subject such as standards of coverage, elements of response time, and developing strategic plans" (CFAI, 2000, p. 1.7).

In this manual the CFAI provides fire departments seeking national accreditation "definitions of elements of response time" (CFAI, 2000, p. 3.37). Included in this section of the Manual is a paragraph titled "alarm processing," which is defined as follows:

> The time interval from the point at which a request or alarm is received and transmitted to emergency responders. Alarm processing time is the time interval between realization that an emergency exists up to the point that this information is retransmitted via the internal alarm system to the attention of the specific agency's resources. The benchmark for this element of response time is a 50-second time frame. (CFAI, p. 3.39)

On February 21, 2003 the PFD was awarded "Accredited Agency" status by the Commission on Fire Accreditation International (CFAI). As an Accredited Agency, PFD was required to publish an *Accreditation Self-Assessment Manual* (PFD, 2002), in which PFD had to

document successfully meeting nationally and internationally recognized goals and objectives or *performance indicators*, providing both a benchmarking and planning tool for the organization. Included in this document are goals and objectives relative to the organization's operational response goals. A review of this Manual identified the following *performance indicators* relevant to the topic of this applied research paper:

1. 5A.1 – Given the agency's "standard of response coverage" and emergency deployment objectives as described in Criterion 3A.2, the agency meets their response time, pumping capacity and apparatus and equipment deployment objectives. (pp. 113-116).
2. 5A.7 – The agency's information system allows for analysis of its emergency response reporting capability. (pp. 125-127).
3. 5G.1 – Given the agency's "standard of response coverage" and emergency deployment objectives as described in Criterion 3A.2, the agency meets their response time, apparatus and equipment objectives for each type and magnitude of emergency medical deployment objective. (pp. 217-221).

In each of these performance indictors PFD identified a standard of 60 seconds for call processing time. In the *appraisal* section of 5A.7, PFD noted the following concern:

> Ideally the Agency would have accurate incident reporting data of all aspects of the system over which we or contracted agencies have any control. For E-911 initiated calls the first benchmark in question is the time interval from primary public safety answering point (PSAP) notification to 911 pick-up at the Douglas County Sheriff's Office (DCSO), the Agency's dispatch provider. When this initial call processing is handled by an agency other than DCSO (e.g. Parker Police, Aurora Police/Fire Dispatch, etc.) this data, while

very important to the Agency's overall response measurement, cannot be captured. (p. 125)

A companion document PFD's *Accreditation Self-Assessment Manual* is the organization's *Risk Assessment and Standard of Response Coverage* (SOC) manual (Baker, 2002). PFD incorporates a performance measure for "call processing time" as a component of this document setting a goal of "1 minute **Call Processing Time** from PSAP to initial fire department notification" (p. 76).

The NFPA provides internationally accepted and recognized standards. The literature review process identified two standards published by the NFPA that relate to, and provide guidance for, defining and measuring call processing times. They are as follows:

1. NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*, provides standards for emergency response; however, fractal performance measures are only provided for the *turnout* and *response time* components of *total reflex time* --- a measure of total response time from PSAP notification to response units arrival on scene of an emergency incident. NFPA 1710 references NFPA 1221 for *call processing* or *dispatch time* standards (2001, Annex, A.3.342.3).
2. NFPA 1221, *Standard for Installation, Maintenance, and Use of Emergency Services Communications Systems*, is the only formal national standard the researcher was able to find that definitively provides performance measures specific to call processing time where alarm notification is processed by multiple PSAPs (2002, Section 6.4.2-6.4.6; Annex, Figure A.6.4.2[a] & [b]).

NFPA 1221 (2002) identifies fractal performance measures including alarm "answered," "transferred," and "dispatching" components. According to NFPA 1221, calls for service placed to primary PSAPs located within emergency services communications systems must be *answered* within 15 seconds 95% of the time. *Dispatching* must then occur within another 60 seconds 95% of the time. This translates to a total of 75 seconds allowed from the initial activation/notification of the 911 system (1st ring) until the call is processed and emergency units are notified of a request for emergency assistance (toned). In circumstances "where primary PSAP is other than communications center" the standard requires these PSAP transfers occur within 30 seconds 95% of the time (Section 6.4.2-6.4.6). This means that requests for service where the primary PSAP is other than a fire department communications center (multiple PSAPs), calls must be processes in less than 105 seconds 95% of the time (15 seconds [*answering* and *transfer* from primary PSAP to communications center] + 15 seconds [*answered* at the communications center] + 60 seconds [*dispatching* at the communications center]).

To summarize, the author was able to find only one national performance standard that addresses call processing time measures where alarm notification is processed by multiple PSAPs. This standard allows 30 seconds for a primary PSAP to process and transfer calls for service to another PSAP; which then answers, processes, and dispatches the appropriate emergency response units within a 75 second "window." Although the CFAI does publish an alarm processing time standard of 50 seconds; they do not recognize an additional time component for PSAP to PSAP call transfers.

On March 23, 2005 Ronny J. Coleman with the CFAI issued a press release and accompanying draft report consisting of data compiled by the agency from Standards of Cover documents submitted by fire departments who have earned Accredited Agency status from

CFAI. This report provides some excellent emergency response data from 72 internationally recognized "best in class" fire departments (Coleman & Gage, 2004). Information contained in this comprehensive report details these fire departments' efforts to define and measure various fractal components of *total reflex time,* including *alarm processing*, *turnout*, and *response time* measures. Noticeably absent from the data however is any mention of either defining or measuring call processing time for incidents where alarm notification is processed by multiple PSAPs.

Further research unearthed many additional references to response time standards and compliance of fire departments and dispatch centers relative to these standards. Included were several articles in an investigative series conducted by the Boston Globe (Dedman, 2003); as well as many applied research projects in archives of the Learning Resource Center located at the National Fire Academy campus of the United States Fire Administration, in Emmitsburg Maryland (Kolesar & Walker, 1974; Moeller, 2001; Stauber, 2003; Werner, 2002). The researcher reviewed two nationally recognized reference texts --- The *Fire Protection Handbook* and *The Fire Chief's Handbook* --- which provided additional information on the topics of response goals and performance standards (Barr & Caputo, 2003; Spahn, 1995). The articles and texts referenced various NFPA standards, including the aforementioned 1221 and 1710; as well as other NFPA standards relative to various specialty responses, such as hazardous materials and technical rescue response. Unfortunately, once again, the vast majority of this literature did not provide relevant data regarding defining or measuring call processing time for incidents where alarm notification is processed by multiple PSAPs. However, the author did find two substantive studies germane to the research.

Campbell, Gridley, and Muelleman (1997) published an exhaustive study of the Kansas City, Missouri emergency medical services (EMS) system in 1993. The primary objective of their study was "to accurately measure the 911 call receipt-to-vehicle departure interval in a system with primary and secondary PSAPs" (p. 492). Their empirical research found that time intervals from primary to secondary PSAPs could be accurately measured "in a system with two separate PSAP CAD clocks" (p. 496). Finally, their research determined that for the Kansas City system --- where the police department served as the primary PSAP for 911 calls --- "the median primary-PSAP call-processing interval was .4 minutes (IQR, .3 to .5 minutes; mode, .3 minutes; range, .2 to 5.2 minutes)" (n.p.). Although the data is not irreducible to fractal measures necessary to determine compliance with NFPA 1221, the median figure of .4 minutes, or 24 seconds, suggests that this system was at least "in the ballpark."

Lerner, Billittier IV, and Adolf (2000) published a study in the January/March 2000 edition of *Prehospital Emergency Care*. The researcher's goal was to "quantify any differences between the times used by public safety answering points (PSAPs) in a multijurisdictional county compared with the atomic clock and to determine whether there was a consistency in any time differences" (p. 28). Their research identified statistically significant mean differences between the PSAP and atomic clock times; with a maximum difference of 551 seconds. Their conclusion was that "results demonstrated significant inaccuracies when multiple PSAPs are involved" (p. 30). At first glance this information appears to contradict the findings of Campbell, Gridley, and Muelleman who posited that multiple PSAP processing times can be accurately measured. However, it really just reinforces the necessity to ensure an accurate and consistent time reference between multiple PSAPs when measuring fractal data.

Procedures

The researcher used action research methodology to answer the research questions. The American Psychological Association's (APA) fifth edition guidelines were used to cite form and references. The desired outcome of this research project was to identify national standards for call processing time where alarm notification is processed by multiple PSAPs; ascertain whether other Colorado Front Range fire departments accurately track call processing times --- including primary PSAP to secondary PSAP call transfers --- as a component of response coverage; and finally, to develop a call processing time standard for inclusion in PFD's SOC.

A literature review process was used to answer Questions 1 and 4 and determine whether there is an accepted fire service standard published at a national level for call processing time where alarm notification is processed by multiple PSAPs; and to review any historical documentation or studies germane to this topic. This information was used to develop a call processing time standard for PFD for inclusion in its existing SOC document; a published component of the department's international Accreditation through the Commission on Fire Accreditation International.

A Call Processing Time Survey (Appendix A) of Colorado Front Range fire departments was used to answer Questions 2 and 3. This research instrument determined what percentage of surveyed agencies accurately track call processing time as a component of a published standard of response, and what percentage of these same agencies with multiple PSAPs include transfer times from primary to secondary PSAPs in their response standard. A follow up question asked whether or not agency communications centers comply with call processing standards in NFPA 1221; i.e. 95% of the time 911 calls are *answered* in less than 15 seconds and *dispatching* occurs within 60 seconds? Content included questions regarding demographics such as: type of fire

department; total number of PSAPs providing service; and percentage of total calls that originate at a primary PSAP that necessitate transfer to a secondary PSAP prior to processing and fire department notification. The survey included 18 fire departments along the Colorado Front Range including a majority of fire departments in the metropolitan Denver area. Departments surveyed, along with the contact individual who provided survey information, were as follows:

- Aurora Fire Department – Dan Martinelli, Operations Chief
- Arvada Fire Department – Sue Steward, Dispatcher
- Boulder Fire Rescue – Dan Hoover, County Communications Director
- Castle Rock Fire & Rescue – Norris Croom, Division Chief - Operations
- Colorado Springs Fire Department – Mike Gower, Battalion Chief
- Cunningham Fire Protection District – Alim Shariff, Battalion Chief
- Denver Fire Department – Paul Hobson, Lieutenant - Dispatch
- Elizabeth Fire Protection District – T. J. Steck, Fire Marshal
- Englewood Fire Rescue – Trina Everhart, Communications Director
- Franktown Fire Protection District – Dave Woodrick, Deputy Chief
- Littleton Fire Rescue – Doug Ireland, Division Chief - Support Services
- Longmont Fire Department – Bill Scott, 911 Director
- North Metro Fire Rescue – Dave Ramos, Battalion Chief
- Poudre Fire Authority – Mike Gress, Operations Chief
- South Metro Fire Rescue – Rich McGowan, Division Chief - Operations
- Thornton Fire Department – Leo Giuliano, Operations Chief
- West Metro Fire Rescue – Mark Krapf, Division Chief - Communications
- Westminster Fire Department – Ken Watkins, Deputy Chief - Technical Services

Limitations and Assumptions

Although not all of the Colorado Front Range fire departments were surveyed, the survey did include the eight largest (number of employees) fire departments in Colorado (MSEC, 2004, pp. 16-21). The methodology was to obtain a random sampling of departments while including the major fire departments along the Colorado Front Range. All fire departments surveyed responded. Some follow-up interviews were necessary to clarify information reported.

Many fire departments with only one PSAP also had separate fire dispatch facilities physically located in the same building and/or general area as the PSAP. While these agencies would also incur "front-end-loaded" times for the primary PSAP to answer, process, and transfer 911 calls to fire dispatch; due to the design of the Call Processing Time Survey this information cannot be culled from the data.

The scope of this research does not include data supporting NFPA response time standards such as fire propagation curves or cardiac resuscitation timelines --- the assumption is made that empirical studies exist to support these national standards. Moreover the research is not intended to discuss or support minimum staffing components of NFPA standards.

Call Processing Time Surveys did not include the following questions that may have allowed for more accurate data:

1. In 2004, what percentage of the time did your department's communication center process requests for service in less than 60 seconds?
2. In what formal document is your fire department's minimum response time objectives published?

This first question would have allowed for further understanding of the problem of 911 transfers between PSAPs and other communication centers. The second question would have provided an

accountability method of confirming that fire departments were in fact measuring call processing times; rather than a survey respondent just reporting that they believed this was being accomplished.

Finally, as is often the case, this research process led the author to explore several peripheral issues beyond the scope of the applied research project. This information is essential for the author to gain a more comprehensive understanding of the problem statement. Unfortunately, due to the limited scope of this research paper, a detailed examination of these peripheral issues cannot be facilitated. However, the author believes there is a singular issue that must be discussed further for the edification of future researchers. This issue is the U.S. Department of Transportation's (USDOT) *Wireless Enhanced 911 Implementation Program*.

Wireless Enhanced 911 (E-911) is a technology mandated by the Federal Communications Commission (FCC) and supported by the U.S. Department of Transportation. Wireless E-911 is "an emergency telephone service that provides immediate caller identification and location. E-911 automatically routes calls to the appropriate PSAP and notifies the dispatcher of the caller's location" (Medical Subcommittee of the Intelligent Transportation Systems America Public Safety Advisory Group [ITS], 2002, p.4). In 1996 the FCC adopted rules that require all wireless carriers to provide wireless enhanced 911 information to PSAPs. "Phase I requires carriers, upon appropriate request by a local PSAP, to report the telephone number of a wireless 911 caller and the location of the antenna that received the call... Phase II requires carriers to provide far more precise location information --- within 50 to 100 meters in most cases --- as well as the caller's wireless phone number" (United States Department of Transportation [USDOT], 2002, p. 2). The FCC published revised orders that generally require Phase II implementation by December 31, 2005 (p. 3).

This issue has many stakeholders including the National Emergency Number Association (NEMA), the Association of Public-Safety Communications Officials (APCO), the National Association of State 9-1-1 Administrators (NASNA), and, of course, the nation's some 7,000 primary PSAPs. ITS (2002) warns:

> Prior to the advent of wireless telephones, the PSAPs were able to automatically locate nearly all 9-1-1 callers. Now, more than half of 9-1-1 calls in metropolitan areas cannot be located because they originate from mobile wireless telephones. PSAPs report a rapidly increasing proportion of calls coming from wireless telephones, now averaging about 27 percent nationwide. (p. 1)

This is extremely important to PFD because more than 75% of all calls for service initiated via 911 in DSCO Dispatch were placed from cellular phones in the first quarter of 2005 (McCaslin, 2005, n.p.). The PSAP at DSCO does not currently meet Phase II requirements for wireless E-911 calls for service. What this means is that for approximately 75% of PFD's calls for emergency service placed via 911 from cellular phones, dispatchers must first determine location of the incident by questioning reporting parties, who often supply erroneous information due to their acute involvement in the emergency. This additional processing time delays the dispatching of emergency responders. Moreover, USDOT (2002) suggests:

> Another difficulty is that without location technology, PSAPs have difficulty determining which calls refer to the same incident. PSAPs accepting wireless 911 calls must handle an astonishing volume of duplicate calls for each incident. One typical metropolitan PSAP receives 80 to 100 calls per car crash, compared to an average of six per crash before it accepted wireless 911 calls. (p. 2)

What affect does this have on PFD, and the scope of this research project? The researcher found that DCSO Dispatch is actually involved in "Project Locate," a lodestar component of wireless E-911 efforts at a national level. Project Locate is sponsored by APCO and "was created to find ways to hasten the deployment of wireless 911 Phase II" (Glover, n.d., p. 10). The ultimate goal of this applied research project was to reduce total reflex time by defining, monitoring, and ensuring call processing time standards with regard to incidents where alarm notification is processed by multiple PSAPs. Becoming a more assertive and involved stakeholder in Phase II implementation of wireless E-911 at the four PSAPs serving PFD may have the greatest impact in reducing call processing times, and consequently total reflex times on a majority of PFD's responses to calls for service via the 911 system. Since this is an issue that affects all fire departments to some degree the researcher strongly suggests these agencies take an active role as stakeholders in the wireless E-911 process.

Definition of Terms

Call processing time (i.e. alarm processing time): The fractal measure beginning from the point of PSAP notification and ending when fire units are notified of ("toned to") the emergency.

DCSP Dispatch: Parker Fire District's emergency communications dispatch center and the primary PSAP for Douglas County.

Fire authority fire department: Service area can include multiple cities and towns as well as unincorporated areas and receives mixed funding through property and sales tax revenue.

Front Range: The City and County of Denver and those geographic areas, from Colorado Springs to Fort Collins, along the Interstate 25 corridor.

IQR: Interquartile range; the difference between the 25th and 75th percentile.

Median: A statistical term defining a number in an ordered number string where there is a equal number of values above and below.

Mode: A statistical term defining the most frequently occurring number in a string.

Municipal fire department: Service area is a city or town and is generally funded by sales tax revenues.

NFIRS: National Fire Incident Reporting System.

Primary PSAP: A facility where 911 calls are first answered and processed.

Secondary PSAP: A facility where 911 calls have been transferred for processing by a primary PSAP.

Special district fire department: Service area can include multiple cities and towns as well as unincorporated areas and receives most of its funding through property tax revenue.

Standard of Cover: A written document that provides policy direction regarding how and when an agency's resources will respond when requested; combining service level objectives with staffing levels.

Total reflex time: the time from receipt of an emergency call at the 911 PSAP until the first EMS or fire unit arrives on scene.

Results

The results of this applied research project were derived from the literature reviewed as well as the procedures completed. Four research questions were solicited and answered based on evaluation of applied research projects published as part of the NFA's Executive Fire Officer Program (EFOP), articles, books, Internet resources, national standards, PFD response goals and published standards of coverage, and a survey of Colorado Front Range fire departments. The

research questions are listed below, with research results from each question cited in narrative form.

Question 1. Is there a fire service standard for call processing time where alarm notification is processed by multiple PSAPs? The research identified two nationally recognized call processing time standards in the fire service; published by the NFPA (1221) and the CFAI. The CFAI standard requires call processing in less than 50 seconds as a benchmark. NFPA 1221 is frequently referenced by other nationally recognized fire service texts; comparatively the researcher was unable to find additional references to the CFAI standard. The NFPA 1221 standard requires call processing in less than 75 seconds 95% of the time where the primary PSAP is the communications center. This includes 15 seconds to *answer* the phone plus 60 seconds to *dispatch* the call. When the primary PSAP is other than the communications center, call processing from primary PSAP to the secondary PSAP at the communications center must be completed within 30 seconds 95 % of the time. This translates to a total of 105 seconds allowed for total call processing from the initial ring at the primary PSAP to fire department notification of the emergency incident.

Question 2. What percentage of Colorado Front Range fire departments accurately track call processing time as a component of a standard of response? Survey respondents included 9 municipal fire departments, 8 special districts, and 1 fire authority; a total of 18 fire departments. Of these fire departments, 14 (approximately 78%) reported they accurately track call processing time as a component of an approved and published response standard. Of the 14 respondents that reportedly track call processing time only 5 stated their communications centers comply with NFPA 1221 (Appendix B).

Question 3. What percentage of Colorado Front Range fire departments whose dispatch is not always the PSAP include total call processing time in their standard of response; including transfer time from PSAP to PSAP and/or PSAP to fire dispatch? Seven fire departments reported multiple PSAPs in their service areas. None of these departments measure call processing times for the primary PSAP to process and transfer 911 calls to secondary PSAP(s). Five of seven of these fire departments reported having at least two and no more than three PSAPs in their service areas. The remaining two fire departments reported having more than three PSAPs within their service area. Five of the seven (approximately 71%) reported that the majority of their calls for service were processed through multiple PSAPs. The remaining two departments reported that less than 25% of their calls were processed via a PSAP to PSAP transfer process (Appendix B).

Question 4. What should the recommended call processing time be for PFD in its *Risk Assessment and Standard of Response Coverage*; and is it measurable? The only uniformly and nationally recognized standard for call processing is NFPA 1211. The literature was not conclusive as to whether this data is currently measurable for PFD. This precipitated additional research specific to the primary PSAPs serving the PFD; as well as PFD's communications center. This information is presented in the *Discussion* component of this applied research paper.

Discussion

The research answered several relevant questions: Is there a call processing time standard for incidents where alarm notification is processed by multiple PSAPs; should PFD adopt this standard as part of its response time objectives; and can it be measured?

In answer to the first query; there is a call processing standard. NFPA 1221, *Standard for Installation, Maintenance, and Use of Emergency Services Communications Systems* is the only definitive national standard for call processing time where alarm notification is processed by multiple PSAPs. The answers to the final two questions are not as simple and have elicited a more informed and comprehensive understanding of the research topic.

In answer to the second query; PFD has adopted NFPA 1221 for alarms where the primary PSAP is DCSO as a component of its *Strategic Plan* and *Risk Assessment and Standard of Response Coverage* (SOC). In March 2005, DCSO Dispatch processed approximately 78% of alarms within 75 seconds from initial PSAP notification (1st ring) to fire department units dispatched (DCSO, 2005, n.p.). PFD should also adopt the section of NFPA 1221 that addresses alarm times where the primary PSAP is not DCSO. Failure to do so would preclude PFD from measuring or evaluating a significant fractal of call processing time as a component of its standard of response coverage. Because this front-end-loading occurs on a large number of emergency responses, PFD is currently unable to determine whether a meaningful response standard is being met.

However, there is a much more elusive question that must be answered to really understand the issue. The way NFPA 1221 is written, an additional 30 seconds for call processing is allowed for alarms with multiple PSAPs. This begs the question; while this additional 30 seconds is "allowed" by NFPA, where does it come from? More importantly, should an additional 30 seconds be allowed? If 6 minutes total reflex time is the goal --- due to objective and empirical data supporting that time, i.e. cardiac and fire time/temperature studies --- does this mean that fire departments operating within a multiple PSAP system must "make up" this 30 seconds of "front-end-loading" by reducing other components of *total reflex time* such as

turnout time or *travel time*? Must they distribute fire stations in higher densities due to "make up for lost time?" Neither NFPA 1221, or 1710, nor any of the other literature reviewed answers this question. Bottom line; heart attacks and structure fires don't know if they're occurring in jurisdictions with multiple PSAPs. These events won't "pause" for the additional 30 seconds of call processing time "allowed" in NFPA 1221. Reluctantly, the researcher chose to include this additional transfer time as a component of PFD's response goals --- with the caveat of another recommendation to explore, evaluate, and implement technological means of direct and immediate transfer of 911 calls from primary PSAPs to the agency providing fire dispatch services to PFD with a goal to reduce and/or eliminate multiple PSAP transfer time.

In answer to the third and final query; the researcher was able to work with one of the three primary PSAPs serving PFD --- Town of Parker Police --- to capture fractal measures for call processing times from the primary PSAP notification to transfer to DCSO Dispatch. Survey data indicates that PFD is the first fire department along the Colorado Front Range to successfully capture and measure this time as a component of its call processing standard (Appendix C). Moreover, the data indicates that the Town of Parker Police PSAP is very close to meeting NFPA 1221, *answering* and *transferring* 90% of alarms processed in March, 2005 within 30 seconds (Parker Police Department, 2005, n.p.). While this information is now being routinely captured, compiled, and published by Parker Police, tying it to incident data published by DCSO Dispatch for PFD NFIRS reporting must be accomplished manually, and is an inefficient and time consuming process. Currently, this is the only way to include multiple PSAP call processing times as a component of *total reflex time* measures. The researcher is attempting to work with PFD's other two primary PSAPs --- Arapahoe County and the City of Aurora --- to capture these agency's call processing and transfer data as well.

In summary, not all Colorado Front Range fire departments surveyed have a published standard of cover with minimum response time objectives. Of the fire departments that do, not all track call processing time as a component of these objectives. Finally, none of the fire departments with multiple PSAPs include call processing and transfer time from the primary PSAP to fire dispatch. A frightening prospect is that this time could be 30 seconds... or it could be 30 minutes; the fire service really doesn't know. Fire departments should work to remedy these deficiencies if they intend on meeting national standards for emergency response. Without accurately measuring fractal components of total reflex time, fire departments will never effectively evaluate their service levels or be able to measure efficiency of response to their citizens' request for emergency assistance. Bottom line; "what gets measured gets noticed." Moreover, since tracking and measuring is often times the result of fire department impetus, leaving it up to the emergency services communication systems may not be an effective method of ensuring NFPA 1221 compliance.

Recommendations

The research identified recommended changes for the PFD; and in some cases the fire service in general. Although these recommendations are directed toward PFD, many of them may be germane to other fire departments with similar issues and concerns. The research suggests the following changes:

1. Revise PFD's *Risk Assessment and Standard of Response Coverage* (Appendix D) and *Strategic Plan* (Appendix E) to include a fractal measure of the time it takes for primary PSAPs to process and transfer requests for service to the District's communication center (currently DCSO Dispatch), as a component of PFD's existing call processing time

standard. The PFD adopted standard should meet or exceed the NFPA 1221 Standard (Appendices C & D).

2. Continue to compile data from the primary PSAP at the Town of Parker Police detailing transfer times to DCSO Dispatch. The researcher has already begun this process as a result of the research with March 2005 data shown in Appendix C.
3. Continue to pursue data collection from the primary PSAPs serving Arapahoe County and the City of Aurora detailing transfer times to DCSO Dispatch.
4. Develop and implement a more efficient (automatic) process of compiling total call processing time for incidents involving multiple PSAPs.
5. Explore, evaluate, and implement technological means (e.g. "one button transfer") of direct and immediate transfer of 911 calls from primary PSAPs to the agency providing fire dispatch services to PFD (currently DCSO Dispatch) to reduce and/or eliminate multiple PSAP transfer times.
6. Pursue grants to upgrade computer-aided dispatch (CAD) technology used in primary and secondary PSAPs to facilitate more timely transfer of data and call processing between PSAPS.
7. Work with the State of Colorado E-911 Board of Directors to legislate mandatory compliance with NFPA 1221 by all PSAPs.
8. Work with the State of Colorado E-911 Board of Directors and the four PSAPs serving PFD to implement Phase II of the FCC's mandated wireless E-911 program.

Future readers of this applied research project are encouraged to develop and evaluate their stated response goals holistically --- including call processing components; multiple PSAP answering, processing, and transferring measurements when applicable; and Phase I and II

implementation of wireless E-911. Moreover, while national standards do allow an additional 30 seconds for multiple PSAP transfers; fire departments must understand that this time impacts their overall response times (total reflex time) and consequently their service to citizens.

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Appendix A

Call Processing Time Survey

Instructions: Please complete the survey below by typing in the information requested and highlighting the appropriate answer to each of the question.

Example:

Fire department: Parker Fire District .

1. Highlight the box that best describes your fire department.

    - City or Town (Municipal)
    - Fire Authority
    - Special District

Fire department: .

Name of individual completing survey: .

Rank of individual completing survey: .

Please mark an "X" if you wish to have survey results emailed to you: .

Email address: .

1. Highlight the box that best describes your fire department.

    - City or Town (Municipal)
    - Fire Authority
    - Special District

2. Does your fire department have an approved and published "standard of cover"; including specific minimum response time objectives?

    - YES
    - NO

3. Does your fire department routinely measure call processing times (*dispatch time* as referred to in NFPA 1710); the point of emergency alarm at the PSAP to the point where response units are notified?

    - YES
    - NO

Call Processing Time Survey

4. Does your *communication system* comply with call processing time standards in NPFA 1221; i.e. 95% of the time *dispatching* in ≤ 60 seconds and 95% of the time *answered* in ≤ 15 seconds?

    - YES
    - NO

5. Is there one single public safety answering point (PSAP) that receives all 911 calls placed from within your service area?

    - YES
    - NO

        a) If NO, how many PSAPs receive 911 calls within your fire department's service area?

            - 2
            - 3
            - More Than 3

        b) If YES, does the PSAP also serve as your fire department's communication/dispatch center?

            - YES
            - NO

6. If your fire department has more than one PSAP --- and you measure call processing times --- do you measure the time it takes for the primary PSAP to process and transfer 911 calls to the FD communication center?

    - YES
    - NO

        a) If YES, do you measure this time as a simple average, or as a percentage of time a specific goal is achieved as required by NFPA 1221; e.g. 95% of the time in ≤ 30 seconds?

            - Simple average
            - Percentage of time goal was met as per NFPA 1221

        b) What percentages of total calls originate at a primary PSAP located at a separate location other than the fire department communication/dispatch center?

            - less than 25%
            - 25% to 50%
            - 50% to 75%
            - greater than 75%

Appendix B

Colorado Front Range Fire Department Call Processing Time Survey – Results

Raw Data

N=18

This survey is part of an Executive Fire Officer Applied research project completed by Robert F. Baker, Operations Chief of Parker Fire District. Results of the survey will be made available to other fire departments if requested. The Project is titled: *Developing a Call Processing Time Standard for the Parker Fire Distric*t.

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18 Question 1. My fire department is: Municipal (**9**), Special District (**8**), Fire Authority (**1**)

18 Question 2. Does your fire department have an approved, published *Standard of Cover*, including specific minimum response time objectives? Yes (**14**), No (**4**)

18 Question 3. Does your fire department routinely measure call processing times (*dispatch time* as referred to in NFPA 1710); the point of emergency alarm at the PSAP to the point where response units are notified? Yes (**14**), No (**4**)

15 Question 4. Does your *communication system* comply with call processing time standards in NFPA 1221; i.e. 95% of the time *dispatching* in ≤ 60 seconds & 95% of the time *answered* in ≤ 15 seconds? Yes (**5**), No (**10**)

18 Question 5. Is there one single public safety answering point (PSAP) that receives all 911 calls placed from within your service area? Yes (**11**), No (**7**)

7 a) If no, how many total PSAPs receive 911 calls within your fire department's service area? 2 (**3**), 3 (**2**), >3 (**2**)

Colorado Front Range Fire Department Call Processing Time Survey – Results

7 Question 6. If your fire department has more than one PSAP, and you measure call processing times, do you measure the time it takes for the primary PSAP to process and transfer 911 calls to the secondary PSAP(s)? Yes (**0**), No (**7**)

a) What percentage of your total calls originates at a primary PSAP that is not located at the fire department communication/dispatch center?

< 25% (**2**), 25-50% (**0**), 50-75% (**3**), > 75% (**2**)

Appendix C

911 Call Transfer Statistics – Town of Parker

911 Call Transfer Statistics				
DATE	**START**	**TRANSFER**	**LAPSED**	**TYPE OF CALL**
03/01/05	11:15:16	11:15:35	:19	FIRE
03/01/05	16:57:45	16:58:11	:26	MEDICAL
03/03/05	11:28:54	11:29:11	:17	FIRE
03/03/05	22:01:17	22:01:35	:18	MEDICAL
03/04/05	7:40:35	7:40:52	:17	MEDICAL
03/04/05	14:23:01	14:23:58	:57	FIRE
03/04/05	15:35:10	15:35:29	:19	FIRE ALARM
03/05/05	7:04:18	7:04:29	:11	FIRE ALARM
03/06/05	14:14:13	14:14:26	:13	MEDICAL
03/07/05	20:19:46	20:20:03	:17	MEDICAL
03/08/05	3:29:36	3:29:55	:19	FIRE ALARM
03/08/05	20:24:57	20:25:27	:30	MEDICAL
03/09/05	8:22:44	8:23:05	:21	MEDICAL
03/09/05	17:09:42	17:09:52	:10	MEDICAL
03/10/05	10:33:20	10:33:37	:17	MEDICAL
03/10/05	15:18:13	15:18:24	:11	MEDICAL
03/10/05	21:17:50	21:18:14	:24	MEDICAL
03/12/05	14:02:59	14:03:22	:23	MEDICAL

911 Call Transfer Statistics – Town of Parker

911 Call Transfer Statistics				
DATE	**START**	**TRANSFER**	**LAPSED**	**TYPE OF CALL**
03/13/05	11:28:26	11:28:39	:13	FIRE ALARM
03/13/05	20:01:21	20:01:42	:21	MEDICAL
03/14/05	19:37:21	19:37:35	:14	MEDICAL
03/14/05	23:16:13	23:16:26	:13	MEDICAL
03/15/05	14:45:21	14:45:45	:24	FIRE
03/16/05	14:21:35	14:21:53	:18	MEDICAL
03/17/05	9:36:49	9:37:20	:31	MEDICAL
03/18/05	14:10:46	14:11:27	:41	MEDICAL
03/18/05	17:03:38	17:04:12	:34	FIRE ALARM
03/19/05	10:15:56	10:16:07	:11	MEDICAL
03/19/05	10:40:52	10:41:09	:17	MEDICAL
03/20/05	12:29:16	12:29:34	:18	MEDICAL
03/20/05	7:41:04	7:41:19	:15	FIRE
03/21/05	15:31:32	15:31:43	:11	FIRE ALARM
03/21/05	19:16:59	19:17:35	:36	MEDICAL
03/22/05	19:19:12	19:19:30	:18	MEDICAL
03/23/05	9:40:03	9:40:13	:10	MEDICAL
03/23/05	11:14:24	11:14:49	:25	MEDICAL

911 Call Transfer Statistics – Town of Parker

911 Call Transfer Statistics				
DATE	**START**	**TRANSFER**	**LAPSED**	**TYPE OF CALL**
03/25/05	8:42:34	8:42:47	:13	FIRE ALARM
03/25/05	15:28:35	15:28:55	:20	FIRE ALARM
03/25/05	15:31:54	15:32:09	:15	FIRE ALARM
03/25/05	16:24:08	16:24:34	:26	FIRE ALARM
03/27/05	2:05:46	2:06:03	:17	MEDICAL
03/27/05	13:43:59	13:44:26	:27	MEDICAL
03/27/05	15:56:30	15:56:51	:21	MEDICAL
03/28/05	13:30:40	13:30:55	:15	FIRE
03/28/05	14:33:29	14:33:48	:19	MEDICAL
03/28/05	21:34:34	21:34:53	:19	MEDICAL
03/29/05	3:06:16	3:06:40	:24	MEDICAL
03/29/05	8:40:11	8:40:22	:11	MEDICAL
03/30/05	9:18:11	9:18:34	:23	MEDICAL
03/30/05	16:52:01	16:52:20	:19	MEDICAL
03/31/05	6:43:20	6:43:33	:13	MEDICAL
03/31/05	16:30:45	16:30:57	:12	MEDICAL
Average			:21	
Percent of time call transfer within 30 seconds			90%	

Appendix D

PFD Risk Assessment and Standard of Coverage Response Goals Revision - Draft

SECTION SIX: RESPONSE GOALS FROM STRATEGIC PLAN

In the 2001 Strategic Plan, the Parker Fire Protection District identified the following service standard with regard to response time objectives:

- Provide for the first fire and/or Advanced Life Support (ALS) units on scene within 6 minutes 15 seconds of receipt of an emergency call at the primary 911 Public Safety Answering Point (PSAP), 90% of the time in designated urban response zones[1] (**Total Reflex Time**). The time is divided in the following components to reach the 6 minutes 15 seconds[2] total:
    - 1 minute 15 seconds **Call Processing Time** from PSAP to initial fire department notification: including 15 seconds for *answering* at communications center; and 60 seconds for *dispatching*.
    - 1 minute **Turnout Time** from fire department notification to initial apparatus response.
    - 4 minute **Travel Time** allowing for a travel distance of 2 miles assuming an average response speed of 30 miles per hour.

[1] The Parker Fire Protection District defines designated urban response zones as those geographic areas with greater than two dwelling units per acre that are within a 4 minute response perimeter (based on actual road infrastructure speed limits) of a fire station.

[2] An additional 30 seconds *call processing time* is allowed for *answering* and *transfer* from primary PSAP to fire communications center where the primary PSAP is not the fire department communications center.

- Provide for an ALS transport unit on scene within 8 minutes 15 seconds[2] of receipt of 911 call, 90% of the time for medical calls in designated urban response zones.
- Provide for a firefighting force adequate for initial fire attack within 8 minutes 15 seconds[2], 90% of the time in designated urban response zones.
- Provide a complete initial response alarm assignment within 12 minutes 15 seconds[2] *total reflex time*, 90% of the time, for commercial and residential structure fires and larger scope incidents in designated urban response zones.

Parker Fire Protection District has adopted a *Distribution Policy* based on these objectives. The Agency's *Distribution Policy* is integrated into, and implemented by, formal and published Standard Operating Procedures, as well as incident run cards used by the Douglas County Sheriff's Office Dispatch Section, the Agency's dispatching authority.

[2] An additional 30 seconds *call processing time* is allowed for *answering* and *transfer* from primary PSAP to fire communications center where the primary PSAPs is not the fire department communications center.

Appendix E

PFD Strategic Plan Service Standard Revision - Draft

SERVICE STANDARDS

- Calls dispatched 95% of the time in less than 75 seconds with 95% essential accuracy where the primary PSAP is the fire department communications center. Calls dispatched 95% of the time less than 105 seconds with 95% essential accuracy where the primary PSAP must transfer calls for service to the fire department communications center.
    1. Train dispatchers to process calls in shortest time possible.
    2. Write standards of performance into contracts with supplier of service.
        a. Monitor dispatch times and errors through QA program.
    3. Replace CAD system if unable to perform appropriately in assisting rapid dispatch.
    4. Work with other agencies to form a fire/EMS dispatch center if unable to achieve this goal.
- Fire and ALS units on scene within 6 minutes 15 seconds of receipt of 911 call (Total Reflex Time), 90% of the time in designated urban response zones; and within 6 minutes 45 seconds where the primary PSAP must transfer calls for service to the fire department communications center.
    1. Locate stations so that drive time is less than 3.5 minutes.
        a. Use computer software to predict response times for station locations.
        b. Monitor response times of existing stations to determine efficacy of locations.
    2. Build stations when first due produces 400 calls annually that will not fall within our goal response time from an existing station or automatic aid unless earlier construction is warranted based on risk hazard assessment.

3. Locate stations with access to collectors or arterials that maximize coverage.
4. Design stations and systems to keep turnout time less than 60 seconds on the average.
    a. Monitor turnout times for stations and crews to determine systems or designs that facilitate turnout.
5. Use closest appropriate unit response whenever possible.
    a. Implement policies with neighboring departments.
    b. Use AVL /CAD technology to select closest unit.

- Transport unit on scene within 8 minutes 15 seconds of receipt of 911 call (Total Reflex Time), 90% of the time for medical calls in designated urban response zones; and within 8 minutes 45 seconds where the primary PSAP must transfer calls for service to the fire department communications center.
    1. Locate stations so that drive time is less than 3.5 minutes from any station.
        a. Use computer software to predict response times for station locations.
        b. Monitor response times of existing stations to determine efficacy of locations.
    2. Locate stations with access to collectors or arterials that maximize coverage.
    3. Design stations and systems to keep turnout time less than 60 seconds on the average.
        a. Monitor turnout times for stations and crews to determine systems or designs that facilitate turnout.
        b. Implement policies with neighboring departments.
    4. Use closest appropriate unit response whenever possible.
        a. Use AVL /CAD technology to select closest units.
- Firefighting force adequate for initial fire attack within 8 minutes 15 seconds (Total Reflex Time), 90% of the time in designated urban response zones; and within 8 minutes 45 seconds

where the primary PSAP must transfer calls for service to the fire department communications center.

1. Station locations designed so second and third due engine can arrive within the 8 minute guideline at least 90% of the time.
    a. Monitor response times for first, second, and third arriving units.
    b. Determine methods to record time of firefighting start or set up time length.

- Complete initial response alarm assignment arrives within 12 minutes 15 seconds 90% of the time for commercial and residential structure fires and larger scope incidents in designated urban response zones; and within 12 minutes 45 seconds where the primary PSAP must transfer calls for service to the fire department communications center.